Abstract Submitted
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Wind Tunnel Testing of a Hydrogen Jet in a Turbulent Crossflow Altered by a Dielectric Barrier Discharge[1] RYAN FONTAINE, Coordinated Science Laboratory, University of Illinois, JONATHAN RETTER, Department of Aerospace Engineering, University of Illinois, JONATHAN FREUND, Departments of Mechanical Science & Engineering and Aerospace Engineering, University of Illinois, NICK GLUMAC, Department of Mechanical Engineering, University of Illinois, GREGORY ELLIOTT, Department of Aerospace Engineering, University of Illinois
— It has been demonstrated that plasmas can fundamentally alter the combustion process. The radical production can decrease combustion timescales and the body force produced by the driving electric currents can improve fuel/oxidizer mixing and alter the shape of the steady state flame. We study these mechanisms for a fuel jet exhausting into a well-characterized turbulent cross-flow of air acted upon by a Dielectric Barrier Discharge (DBD) plasma produced at the jet exit. The fuel is hydrogen diluted in cases with N_2 and Ar. Laser breakdown provides the energy deposition for ignition above the jet. The likelihood of sustained ignition for various fuel compositions and cross-flow conditions is considered along with flame properties once ignited both under the influence of the DBD plasma and without. Additionally, the effect of the DBD on flame blow-off is investigated. The jet is varied from low-momentum ratios ($\sim 10^{-4}$) to high (~ 1) to alter the relative contributions of the body forces and radical production on the combustion process. This system is studied to quantify the effect of the DBD plasma and discover opportunities for control.

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